

Adaptive Responses of *Carum copticum* to in vitro Salt Stress

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Abstract : Salinity is one of the most widespread agricultural problems in arid and semi-arid areas that limits the plant growth and crop productivity. In this study, the salt stress effects on protein, reducing sugar, proline contents and antioxidant enzymes activities of *Carum copticum* L. under in vitro conditions were studied. Seeds of *C. copticum* were cultured in Murashige and Skoog (MS) medium containing 0, 25, 50, 100 and 150 mM NaCl and calli were cultured in MS medium containing 1 μ M 2, 4-dichlorophenoxyacetic acid, 4 μ M benzyl amino purine and different levels of NaCl (0, 25, 50, 100 and 150 mM). After NaCl treatment for 28 days, the proline and reducing sugar contents of shoots, roots and calli increased significantly in relation to the severity of the salt stress. The highest amount of proline and carbohydrate were observed at 150 and 100 mM NaCl, respectively. The reducing sugar accumulation in shoots was the highest as compared to roots, whereas, proline contents did not show any significant difference in roots and shoots under salt stress. The results showed significant reduction of protein contents in seedlings and calli. Based on these results, proteins extracted from the shoots, roots and calli of *C. copticum* treated with 150 mM NaCl showed the lowest contents. The positive relationships were observed between activity of antioxidant enzymes and the increase in stress levels. Catalase, ascorbate peroxidase and superoxide dismutase activity increased significantly under salt concentrations in comparison to the control. These results suggest that the accumulation of proline and sugars, and activation of antioxidant enzymes play adaptive roles in the adaptation of seedlings and callus of *C. copticum* to saline conditions.

Keywords : antioxidant enzymes, *Carum copticum*, organic solutes, salt stress

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